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CALIBRATION OF mb(Pn), mb(Lg) SCALES AND THE TRANSPORTABILITY OF THE Mo:mb DISCRIMINANT TO NEW TECTONIC REGIONS*

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We have developed Mo:mb relationships for earthquakes and explosions in central Asia using regional waveform data from the Chinese broadband, digital station, WMQ. Regional magnitude scales, mb(Pn) and mb(Lg), were established by (1) determining the attenuation rates of Pn and Lg waves, (2) calibrating the mb(Pn) against the teleseismic mb, and (3) applying Nuttli's method to the Lg waves. Moments for earthquakes and explosions were obtained using the Bolt and Herraiz (1983) method. CMT moments for earthquakes and moment estimates of the Soviet JVE explosions based on regional data were used for calibration purposes. The Pn results for central Asian earthquakes and explosions are in excellent agreement with the results for western United States. These results demonstrate the Mo:mb discriminant is portable to other regions and support quasi-theoretical claims that Mo:mb for explosions detonated in different emplacement media will transport as well. However, successful porting of the Mo:mb(Pn) discriminant depended upon the availability of mb(Lg) in order to establish the teleseismic mb bias for regions being calibrated. Region-specific mb bias must be accounted for whenever magnitude scales are calibrated against the teleseismic mb. Transporting Mo:mb(Lg) can be problematic because attenuation rates based on coda waves or Lg waves from earthquakes may not necessarily apply to Lg waves from explosions. This is demonstrated for western United States where the coda Q's measured from earthquake data are much higher than the coda Q's from analysis of explosion data. In this study, mb(Lg)'s for earthquakes located close to NTS are greatly over-estimated using the Q values determined from codas of NTS explosions. This is apparently not a problem for Lg calibration in central Asia, and the reason for this could be related to differences in velocity and/or Q structures for the two regions. Other important considerations are (1) the mechanisms of Lg generation being quite different for earthquakes and explosions, (2) the character of Lg propagation on short paths (< 400 km) for NTS explosions versus long paths (1000 km) for East Kazakh explosions, and (3) the properties of coda wave spreading as a function of distance and velocity structures for different tectonic regions.

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